DOCUMENT RESUME

ED 076 238 PS 006 444

AUTHOR Klein, Robert A.
TITLE Cognitive Growth in Young Children: Some Theoretical Implications Pertaining to Identity, Language and Memory.
INSTITUTION New Mexico Univ., Albuquerque. School of Medicine.
PUB DATE 16 Feb 73
NOTE 14p.; Paper presented at the Annual UAP-USC Conference on Piagetian Theory and the Helping Professions (3rd, University of Southern California, Los Angeles, February 16, 1973)

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS Abstraction Levels; *Child Development; *Cognitive Development; *Language Development; Language Learning Levels; Learning Theories; Literature Reviews; *Memory; Preschool Learning; Serial Ordering
IDENTIFIERS *Piaget (Jean)

ABSTRACT

Language as an identifiable cognitive behavior must be studied in relation to identity and memory, all of whose structures undergo progressive changes as the child develops. The organization of the development of the organism depends upon relatively ordered structures of growth, following foreseeable pathways or creodes. The processes occurring within each creode, however, are susceptible to certain environmental modifications. Current research indicates that the acquisition of language parallels the development of identity and renders it meaningful. Research has shown that the style of reasoning used by a child is very much related to the language used and that a close relationship exists between the structure of a term and the developmental stages of seriation. Cognitive operations never exist in isolation; the acquisition of one enhances or potentiates the acquisition of another. Research has shown that the development of the memory schema lies within the developmental confines of identity and language. It is only under the circumstances of the changed and changing schema that memory becomes not more accurate but more in concert with the other same-level cognitions and modalities of thinking. The observation of qualitative differences of behavior at different chronological levels establishes memory as possessing the structure(s) through which identity is assimilated and language accommodated. Memory, and its manifestation via increasingly accurate reproduction of the original stimulus, is an integrative and integrated factor in cognitive growth. (KM)

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Robert A. Klein

Programs for Children

University of New Mexico School of Medicine

Presented at: Third Annual UAP-USC Conference on Piagetian Theory and the Helping Professions, University of Southern California February 16, 1973

PS 006444

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Robert A. Klein
Programs for Children
University of New Mexico School of Medicine

The study of the developmental process within a Piagetian framework presupposes an understanding of the term "development" which is intimately linked to the very nature of the process itself. Comparing development with learning, for example, Piaget takes pains to underscore the uniqueness of its action within the total epistemological context, emphasizing the child's ability to "elaborate a more and more adequate knowledge of reality. It is precisely the successive forms of his activity in the course of his development that determines his modes of knowledge (Furth, 1969)." "The development of knowledge," says Piaget (Voyat, 1971), "is a spontaneous process, tied to the whole process of embryogenesis. Embryogenesis concerns the development of the body, but it concerns as well the development of the nervous system and the development of mental functions; in the case of the development of knowledge in children, embryogenesis ends only in adulthood. It is a total developmental process, which we must restitute in its general biological context. In other words, development is a process which concerns the totality of the structure of knowledge."

Two crucially important points are made in the above quotation. The first is the explicit caveat that no structure or operation can be investigated

and understood removed and in isolation from the system which defines it as an entity. That is, in order for a cognitive behavior to "make sense" it must be seen as part of a more global cognitive activity; isolating it, as does the biologist who studies the tissue culture in vitro in the test-tube, merely serves to distort the reality of its function(s) as part of a living, thinking organism. This organism, furthermore, is an actively self-regulating open system whose processes of adaptation--the progressive tendency toward ordered development--move in the direction of what Furth (1969) calls "a dynamic integration".

It is here that language as an identifiable cognitive behavior must be studied in relation to identity and memory, all of whose structures undergo progressive changes as the child develops. The dynamic complexity of these relationships can be clearly seen in the young child as the changing memory structures establish "new" responses at varying age levels. Consequently, to speak of language development per se or identity alone is a contradiction of wide proportions.

The second important point made by Piaget in the comment cited above is the stress laid on the biological components of development, what Piaget refers to as embryogenesis. Waddington, a British geneticist, suggests (1961) that the processes which are involved in the growth of living things can be subsumed under the three categories, or "biological time scales," of evolution, heredity, and development. Development, within his paradigm, is very much a part of not only the growth of a particular living thing, but is also an integral component of the very life cycle itself.

The system of development, says Waddington, is a dynamic enterprise. Embryonic cells are constantly in process, ultimately responding to an "organizer which may switch them into developing as a nervous system or not. If they are left too long without being acted on by an organizer, their readiness to respond will disappear again. There is only a certain phase in their progressive changes in which they are, as we say, 'competent' to react."

Within this so-called "competence" Waddington suggests a "path of change which is determined by the initial conditions of a system and which once entered upon cannot be abandoned." This path, or "creode," refers to a "trajectory of progressive developmental change, which arises from the nature of the casual organization at its starting point.... (1960)."

Importantly, development is <u>not</u> inflexible and in fact the developmental pathway (creode) manifests an equilibrium between inflexibility ("tendency to reach the normal end-result in spite of abnormal conditions") and flexibility ("tendency to be modified in response to circumstances"): the course of development "tends to follow its normal path...."

The organization of the development of the organism thus depends upon relatively ordered structures of growth, following foreseeable if not predictable pathways; the processes occurring within each creode, however, are susceptible to certain environmental modifications while retaining the "normal" biological thrust inherent in the particular structure itself. The interactive process within the molar system--a cybernetic arrangement of interacting molecular systems--serves to "induct" or "evoke" the potential in much the same way as

genes serve to potentiate as a result of their enzymatic interaction. Yet, it is precisely because of this potentiality that, like genetic structure, developmental changes do not depend upon a predetermined end-point. We must, this attitude clearly suggests, interpret development--be it genetic, physiological, or cognitive--as it proceeds within the organized system of which it is a part.

The development of identity and the acquisition of language is here a case in point. Current research indicates that the acquisition of language parallels the development of identity and in fact renders it meaningful (i.e., the path can be traced through the various pre-operational levels, its trajectory remaining qualitatively consistent throughout the child's pre-operational period). Up to the age of 7 or so, the child increasingly makes "objective" sense out of the material at hand and his linguistic output reflects the stage of his cognitive development.

Identity development, crucial to the cognitively organized system within which language is expressed, is not merely a measurable quantitative change where accretions serve to cause the child to suddenly "grasp" the notions inherent in the transformation of matter. The growth of both identity and language involves instead definitive qualitative changes; it is a "change of paradigm of thought, it is a developmental change and not simply the extension of a given category of knowledge (Voyat)." It is this "paradigm of thought" which is the creode of cognitive development.

This relationship is strikingly exhibited in an examination of the actual language used by children at various ages. Psycholinguists have categorized language use according to certain relational factors and Sinclair-de-Zwart (1969)

has been most instrumental in studying these scalars and vectors in relation to Piagetian theoretical findings. Work by Sinclair-de-Zwart indicates that the style of reasoning utilized by a child is very much related to the language used; that is, what she calls scalars and vectors do not occur haphazardly throughout a child's language production, but very directly reflect the child's stage of language development. She found, in addition, a close relationship between the structure of a term and the developmental stages of seriation. Thus, for example, younger subjects responded as follows: "This is big, this is small; that's long, that's short." In contrast, older children tended to rely more on vectors, on more directly relational structures: "This one is bigger than the other; that's shorter than this one."

In a recent study by this author (1971), responses were arranged according to four categories:* Scalar one (S_1), Scalar two (S_2), Scalar three (S_3), Vector four (V_4). An example of each is shown below.

S_1 (Ty--age 3 - 2)

E) Is it (clay snake) like that one?
T) (Nods yes)
E) How come it's like that one?
T) This one's big and this one's small.
E) ..is that like that one or not like that one?
T) Not like...
E) How come?
T) Because this one's big so it can't match.

* Scalars are separated comparisons of objects with a gradually increasing directly expressed relational interaction between them. Vectors clearly indicate a level of intended and reciprocal relational interaction.

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S_2 (Heather -- age 4 - 4)

H) I did it--I made this just like this.
E) What about them makes them look like each other?
H) I don't know.
E) You tell me--why?
H) Because they're both bigger.

S_3 (Victor -- age 5 - 7)

E) Is that (arc-wire) like that or not like that?
V) It's like that.
E) How come it's like that? You tell me why it's like that.
V) It's more straighter and this one is more rounder and this one is a little rounder.
E) So is it like that or not like that?
V) It is.

V_4 (Leila -- age 6 - 0)

E) How else is that one like that one (arc-wire)?
L) They're both green.
E) What about their size?
L) One's bigger than the other.

What is interesting here is that these examples indicate a trend or thrust rather than any kind of inflexible unidirectional isomorphism. The qualitative within-stage changes which these results suggest further illuminate the importance of emphasizing the role of the creode in development. For, contrary to a number of Piaget's critics, development is here portrayed as the process and end-product both, not in any mandatory, ex cathedra manner, but as a sensitive barometer of the child's current position in his/her particular stage of cognitive enterprise.

Further, the data strongly suggest that language is structured by thought and logic, that it in fact is not the well-spring from which logic comes forth. Cognitions develop beginning with the sensori-motor period culminating in their qualitative development in the logical coordination of actions. Vector four appears to represent the linguistic expression of the ability to "coordinate" heretofore cognitively unrelated dimensions; what has been assimilated is now likewise accommodated.

The above examples begin to make clear the interactive, progressive processes which in effect define the level and structure of cognition. They furthermore underscore the fact that cognitive operations (whether identity or otherwise) never exist in isolation, and that one operation (in this case, identity) is intimately related to and is in effect another operation (in this case, language). The nature of the interrelationship (one could almost call it the identity of the identity) is such that the acquisition of the one enhances--or potentiates--the acquisition of the other. With this knowledge we can investigate the hierarchy of operations--the path of competence--while simultaneously paying attention to the ongoing internal actions which evoke that development described above. An organismic, multi-component process based on interactive cybernetic principles, it is nonetheless a system which is open to the flow and input of the environment.

Piaget, Elkind and Flavell (1969) suggest, elaborates a "process of changes in the structure of behavior and of thought that come with the infant's or child's interacting with his circumstances... Orderliness in the course of

development derives not only from genetic preprogramming, but also from the nature of the manner in which these ready-made sensorimotor systems are capable of being coordinated and differentiated in the course of the infant's interaction with his environmental circumstances."

Both the theoretical justification and tentative conclusions from the empirical data establish the evidence for assuming that "the world of the child is qualitatively different from the adult... (it) is not merely a clause of style, or an image; it reflects a reality (Voyat, 1971)." But the determination of an understanding of the cognitive operations just discussed leaves open the possibility, nonetheless, that the child's development of operations is of a quantitative nature, merely experience piling upon experience. Identity might be explained, then, as the repository for true learning experiences while language is a reflection of the developmental maturity, or immaturity (i.e., lack of experience), of the child. In this manner, a parallel, separate development is postulated, growth occurring because of the richness of the soil, perhaps, or the quality of the seed.

This postulation, however, ignores the specific <u>adaptive</u> nature of operative actions and undermines the epistemological foundations which are clearly evident in Piaget's empirical formulations. Specifically, "the biological function of knowing a thing in the environment is to react to the thing in an adaptive manner... We think in order to act (Furth, 1969)." We can see the justification for these remarks in our observations of children in the preoperational period where their knowledge is still determined to a primary extent on external

conditions of action. It is not, however, total knowledge dependent upon action.

Research by Voyat (1971) provides evidence for this. Working with Sioux children, Voyat administered two series of the seriation tasks. After having the children respond spontaneously to the task, he provided each child with information designed to enable the child to correct any errors he had made. Four modalities of learning emerged from the experiment, with each child virtually superimposing his/her modality of learning on his/her particular operatory stage. That is, "the child was unable to learn more than what his operatory level allowed him to (Voyat)." The provision of feedback is apparently not sufficient to enable a child to integrate information from a "higher" level. The results seem to point up the strength of the relationship between the ability to integrate information and a particular level of thinking. ".... one must wait" in short, "for the child's operatory structure to develop to observe the incidence of other modalities of learning," according to Voyat.

What does Voyat mean that "one must wait for operatory structures to develop to observe the incidence of other modalities of learning"?

To begin with, we must accept the necessity of investigating the development of operatory structures through a scheme which is itself changing as the child grows. Memory is a cognitive behavior which elaborates the qualitativeness of the development, in contrast to the apparent quantitative cognitive growth, of the human child. In the above Sioux research we have seen

illustrated the difference between learning and development: the latter as the "totality of the structure of knowledge," the former as "provoked by situations." It is in this integrative context that those data serve to extricate the sequence of the development of the memory schema and place it squarely within the developmental confines of identity and language. In addition, it underscores the Piagetian tenet that the child is "only" capable of assimilating and accommodating to that which his/her operatory level allows him/her to do. It is only under the circumstances of the changed and changing schema that memory becomes not more accurate but more in concert with the other same-level cognitions and modalities of thinking. The child remembers what the schema "allows" him to remember.

As Inhelder points out (1969) and as the previous material suggests, internal mechanisms such as memory are generally thought to involve encoding and decoding properties. Thus, for those investigators who assume that memory is a direct copy of reality, the stability of the code would result in stability of memory. However, Inhelder's seriation results as well as the present conjectures support the assumption that the structure of the code actually changes "in the course of, and perhaps as a function of, the evolution of thinking operations...." (Inhelder).

Furthermore, we can now knowledgeably respond to Inhelder's implicit question: does the change in the structure of memory depend on specifiable laws or does it stem from developmental changes in the cognitive structures themselves? When we speak of recognition, evocation or, in the seriation case,

reconstruction memory we now know, and can specify, the memory image, symbolization and identity operations which make up the growth of the cognitive structures under investigation. The coordination of the operative aspects (actions, operations) and the figurative components (imitation, images) provide the vehicle for this growth.

Thus, the observation of qualitative differences of behavior at different chronological levels establishes memory as possessing the structure(s) through which identity is assimilated and language accommodated. Inhelder says that "memory is the apprehension of that which has been experienced or acquired in the past and implies the conservation of schemes of intelligence as well as conservation of biological mechanisms (1969)." The circle becomes complete. In the case of reconstruction, as well as recognition and evocation, dependence on the memory images and the immediate stimulus configuration varies, with reconstruction theoretically involving a balance of recognition and evocation. The memory trace, and its manifestation via increasingly accurate reproduction of the original stimulus, becomes a doubly integrative and integrated factor in the child's cognitive growth.

The development of memory further integrates the child's cognitive growth (see, e.g., Inhelder, 1969). But, in addition, it gradually and developmentally integrates the linguistic representation (which is stage specific) with, ultimately, accuracy of stimulus reproduction. In this way it preserves and integrates the developmental with the genetic and evolutionary--it is truly an epigenetic phenomenon intimately tied to the mechanics of knowing: language.

identity, and memory as epistemological equivalents. "The introduction and mastery of specific symbol systems represent landmarks in this transition (e.g., from Scalar 1 to Vector 4...) but it is the essential continuity of the developmental process which must not be overlooked (Zimiles, 1963)." Stated a bit differently, we can understand the integrating-organizing process as one of the products of cognitive development. "The subordination of discrete experiences to an organizing principle," notes Schnall (1966), "rests upon cognitive differentiation and hierarchic integration, achieved by the organism in the course of his life in relation to changing environmental opportunities." "...development," says Piaget (Voyat, 1971), "is a process which concerns the totality of the structure of knowledge."

We are now only at the threshold of understanding the intimate relationships between the process and the structure. Studying identity, language and memory is one way to begin.

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